SHORT COMMUNICATION

THE EFFECTS OF ENSILAGE ON THE NUTRITIVE CHARACTERISTICS OF POULTRY WASTE - CARBOHYDRATE MIXTURE AS LIVESTOCK FEED

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ABSTRACT

In a laboratory study, the results of ensiling caged layer poultry waste with carbohydrate sources to enhance its usefulness as feed ingredient for livestock were reported. Poultry waste (20%) mixed with cassava or sorghum flour was ensiled in test-tube silos and sampled at intervals during a 14-day storage period. In both mixtures, the dry matter (DM), crude protein (CP) and pH values were significantly affected ($P < 0.05$) with time after ensiling. The DM values were higher ($P < 0.05$) on day 10 than on day 0, 5 or 14. The poultry waste-sorghum mixture increased in CP level ($P < 0.05$) from 8.0% on day 0 to 9.1% on day 14 while in the cassava mixture CP increased from 7.0% on day 0 to a maximum of 7.6% on day 10. There was a drop in pH from 6.4 to 4.6 in both mixtures at the end of the storage period. The results showed that ensiling cassava or sorghum flour with poultry waste enriched the nitrogen content of the mixture thereby enhancing its usefulness as livestock feed.

Keywords: Poultry waste, carbohydrates, ensiling, chemical composition.

INTRODUCTION

In Nigeria, feed cost alone accounts for over 70% of the total cost of livestock and poultry production in the intensive system (Oluyemi, 1984; Ogunfowora, 1984). It is evident that the current low consumption of animal protein and the increase in demand for livestock and poultry products could be alleviated through appreciable reduction in the cost of livestock feeds. In this country, the conventional protein sources are both scarce and costly due principally to under production, demand as food for humans and as industrial

raw materials. Efforts should therefore be directed at exploring alternative sources of livestock feeds on which there would be little or no competition between man and livestock.

One such feed resource which has for long been receiving considerable attention is poultry waste (droppings). The use of poultry waste as a protein supplement for livestock has been extensively investigated in developed countries (El-Sabban *et al.*, 1970; Evans *et al.*, 1978; Kalch, 1980). In Nigeria, poultry waste as a feedstuff has received some attention (Ibeawuchi *et al.*, 1993). The waste contained 14.6-30.0% crude protein on dry matter basis (Smith *et al.*, 1979; Kayongo and Muinga, 1984). The value could vary with the diet, physiological status and age of the birds (Smith *et al.*, 1979). About 70% of the nitrogen is in the form of uric acid, a superior form of non-protein nitrogen (NPN), which when fed to ruminants would generate rumen ammonia more slowly than urea and therefore less likely to cause ammonia toxicity (Oltjen *et al.*, 1968).

However, the problem with poultry waste is that it is frequently harvested at a moisture content too high to prevent deterioration in conventional facilities. Handling of the waste as a feedstuff is usually difficult due to the wet condition and the odour generated. In this form, the loss of nitrogen through leaching, denitrification and volatilization can be extensive.

Therefore, it might be necessary that the waste be dried, treated with preservative, or ensiled to prevent spoilage. However, the energy cost of drying the material could be enormous and sun-drying may not be effective especially in the wet season. Poultry waste has been preserved successfully with organic acids/compounds (Fontenot *et al.*, 1971;

TABLE 1: CHEMICAL COMPOSITION OF POULTRY WASTE, LAYERS MASH, CASSAVA AND SORGHUM FLOUR

Component	Poultry Waste	Cassava Flour	Sorghum Flour	Layers Mash
Dry Matter (%)	71.50	79.10	79.45	90.80
Crude Protein (%)	28.00	6.50	7.30	15.00
Crude Fibre (%)	12.00	3.40	3.20	4.00
Ether Extract (%)	2.00	1.20	1.50	6.00
Ash (%)	24.50	3.40	3.50	10.50
Nitrogen Free Extract (%)	33.50	85.50	84.50	64.50
Gross Energy (Kcal/kg)	3940.00	30978.33	31073.85	2989.00

TABLE 2: CHEMICAL COMPOSITION OF ENSILED MIXTURE OF POULTRY WASTE AND CASSAVA FLOUR (20:80)

Parameter*	Days After Ensiling			
	0	5	10	14
Dry matter (%)	49.5 ± 0.06 ^b	50.4 ± 1.00 ^b	52.0 ± 0.00	50.4 ± 0.00 ^b
Crude protein (%)	7.0 ± 0.06 ^b	7.4 ± 0.10 ^a	7.6 ± 0.00 ^a	7.4 ± 0.10 ⁱ
Crude fibre (%)	3.1 ± 0.06	3.3 ± 0.10	3.3 ± 0.10	3.3 ± 0.20
Ether extract (%)	1.2 ± 0.10	1.2 ± 0.20	1.2 ± 0.06	1.2 ± 0.10
Ash (%)	3.4 ± 0.00	3.4 ± 0.30	3.4 ± 0.20	3.4 ± 0.20
Nitrogen-free extract (%)	85.3 ± 0.20	84.7 ± 0.10	84.5 ± 0.06	84.7 ± 1.00
pH	4.4 ^a	5.1 ^b	4.6 ^c	4.6 ^c

^{a,b,c} Means in the same rows with different superscripts differ ($P \leq 0.05$)

*Means ± Standard Deviation.

TABLE 3: CHEMICAL COMPOSITION OF ENSILED MIXTURE OF POULTRY WASTE AND SORGHUM FLOUR (20:80).

Parameter*	Days after Ensiling			
	0	5	10	14
Dry Matter (%)	49.5 ± 0.06 ^c	50.7 ± 1.00 ^b	56.0 ± 0.58	50.7 ± 0.00 ^b
Crude Protein (%)	8.0 ± 0.10 ^c	8.6 ± 0.20 ^b	8.8 ± 0.06 ^b	9.1 ± 0.10 ^a
Crude Fibre (%)	3.2 ± 0.06	3.0 ± 1.00	3.0 ± 0.10	2.9 ± 0.10
Ether Extract (%)	1.3 ± 0.06	1.3 ± 0.16	1.3 ± 0.17	1.2 ± 0.10
Ash (%)	3.4 ± 0.20	3.4 ± 0.10	3.4 ± 0.19	3.3 ± 0.20
Nitrogen-free extract (%)	84.1 ± 0.10	83.7 ± 0.20	83.5 ± 1.00	83.5 ± 0.04
pH	6.4 ^a	5.0 ^b	4.5 ^c	4.6 ^c

^{a,b,c} Means in the same row with different superscripts differ ($P < 0.05$)

*Means ± Standard Deviation.

ENSILAGE OF POULTRY WASTE WITH CARBOHYDRATES

Caswell *et al.*, 1975; Anon, 1977). Again, the cost of importing the chemicals could be very high. On the other hand, poultry waste has been successfully ensiled with corn forage (Harmon *et al.*, 1975). The current study was therefore undertaken to investigate the suitability of ensiling the waste with energy yielding carbohydrate sources (Cassava and sorghum flour) as a preliminary step to its use as a feed ingredient. The nutritive characteristics of the ensiled mixtures were assessed.

MATERIALS AND METHODS

About 12kg of waste from caged layers fed a 15% crude protein meal were collected from the Poultry Unit of the University of Agriculture Farm in Makurdi. A polythene sheet was placed underneath the battery cage system to receive the waste. The waste was ensiled with cassava and sorghum flour in six laboratory test-tube silos of 3.8dm³ in the following proportions: (A) 80% cassava flour and 20% poultry waste; (B) 80% sorghum flour and 20% poultry waste. Each mixture (150g) was ensiled in three test-tubes in a completely randomized design. The silos were sealed with corks and candle wax and stored at room temperature (27°C). One test-tube from each treatment was sampled at 0, 5, 10 and 14 days after ensilage. The samples were analysed for dry matter, crude fibre, total ash, ether extract and crude protein by the AOAC (1980) procedure. Gross energy value was estimated as described in Harris *et al.* (1964). Data collected were subjected to analysis of variance as applicable to completely randomized design (Steel and Torrie, 1980) while significant means were identified by Duncan's (1955) Multiple Range Test.

RESULT AND DISCUSSION

The proximate constituents of fresh poultry waste, layers mash, cassava and sorghum flours (Table 1) showed that poultry waste contained much higher crude protein (28%) than the layers mash (15%). The crude protein values for cassava (6.5%) and sorghum flour (7.3%) were relatively poor. The total ash content of

poultry waste (24.5%) was also higher than the level (10.5%) in layers mash. Comparable CP and ash values of poultry waste and layers mash have been reported by Shah and Muller (1982). The proximate constituents of the ensiled mixture of poultry waste and the carbohydrate sources are presented in Tables 2 and 3. The dry matter, crude protein and pH values in both mixtures were significantly affected ($P < 0.05$) with time after ensiling. The dry matter values were higher on day 10 than on day 0, 5, or 14. The crude protein level increased from 8.0% on day 0 to 9.1% on day 14 for sorghum-poultry waste mixture while the cassava-poultry waste mixture crude protein increased from 7.0% on day 0 to a maximum of 7.6% on day 10. The pH dropped from 6.4 to 4.6 in both mixtures at the end of the storage period.

The rate of decline in pH has been shown to be essential in the ensiling process (Wittenbury *et al.*, 1967). The pH is an important factor in stabilizing the material and allowing long term storage. The most significant contribution of the waste to the ensiled mixtures was probably the increase in crude protein level.

The present results indicate that ensiling sorghum or cassava flour with poultry waste was effective in enriching the nitrogen content of the flour which would enhance its usefulness as a livestock feed. Therefore, ensilage as a process in the preservation of fresh poultry waste on short term basis promises to be a more cost effective means of rendering the waste useful as a protein supplement in the diet of livestock.

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